



Ames Research Center
Aeronautical Test and Simulation Division

VIRTUAL SIMULATION LABORATORY

A DEMONSTRATOR PROJECT
FOR A VIRTUAL LABORATORY



Simulation Laboratories



**Ames Research Center
Aeronautical Test and Simulation Division**

WHAT IS IT?

THE VIRTUAL LABORATORY

**> A VIRTUAL ENVIRONMENT PROVIDING REMOTE ACCESS TO ARC
SIMULATION LABORATORIES**

- **Monitor and actively participate in a simulation experiment from any location in US**
 - user defined displays
- **Integrated desktop development system allows researcher to;**
 - develop math models, displays, control systems
 - validate models for higher quality experiments
 - provide fully compatible S/W modules to SimLab
- **Virtual prototyping**
 - cockpit design
 - lab data system layouts
- **Demos, PR, education**
 - demos made available regardless of location
 - include multiple groups simultaneously
 - low cost observers stations

Simulation Laboratories

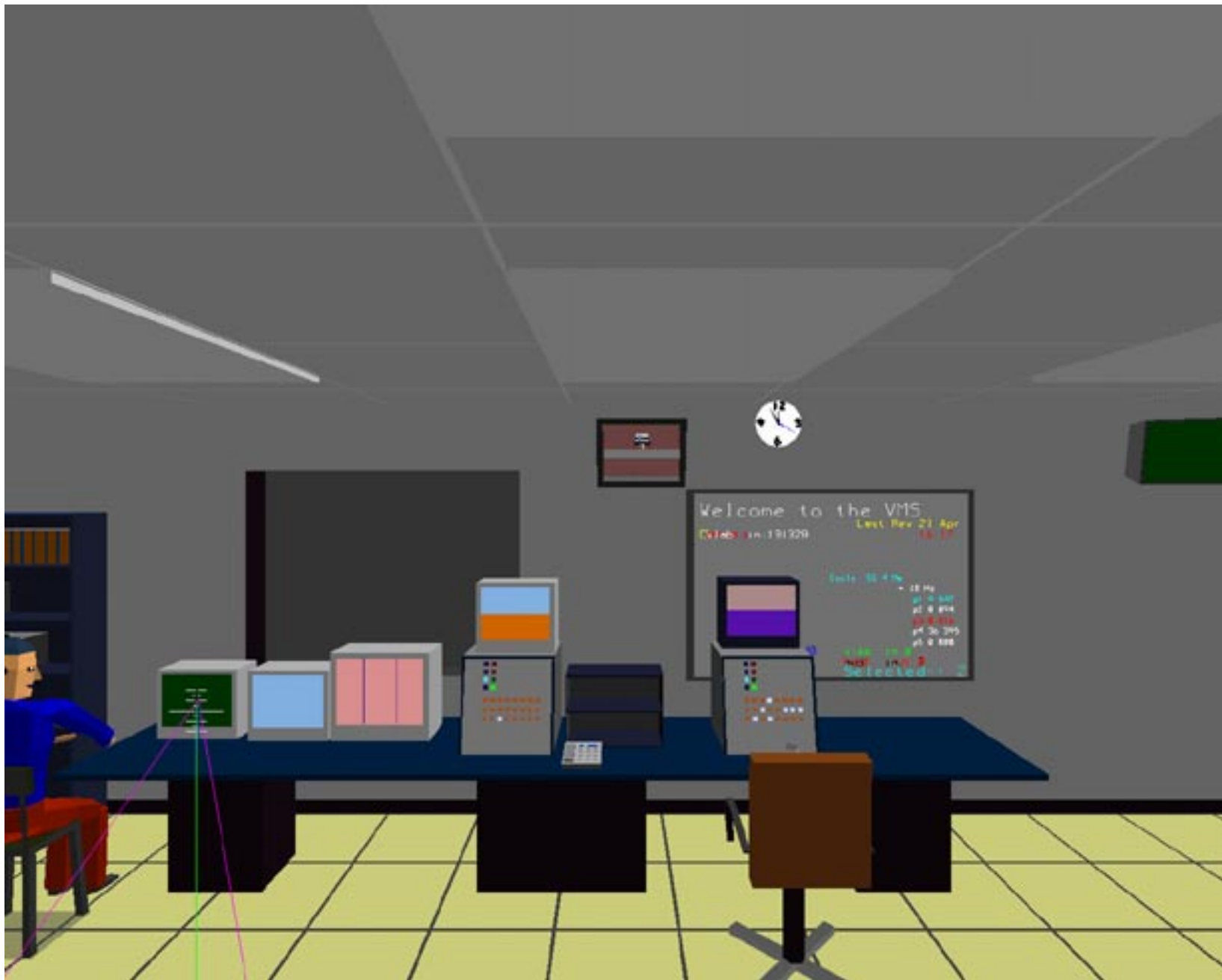


Ames Research Center Aeronautical Test and Simulation Division

WHY DO IT?

CENTRAL ROLE OF SIMULATION IN AIRCRAFT DESIGN CYCLE

- **Delivers NASA's simulation capability to industry's doorstep**
 - ARC simulators are high fidelity, research oriented facilities
 - ARC simulators can be used for specific, focused purposes as well as basic research topics
- **Allows industry to iterate design steps with piloted simulation**
 - faster, less expensive pilot-in-the-loop evaluation of designs
 - closes loop with CFD and WT testing for better design decisions earlier in the process
 - interoperability among AOS facilities such as ATC, SDTF, full mission, and part task
 - collaborative work with Neural Net simulations (Code I)
- **Enables industry/government partnerships to the benefit of US aeronautics**
 - easier access to National facilities
 - shared databases
 - more effective and efficient design process



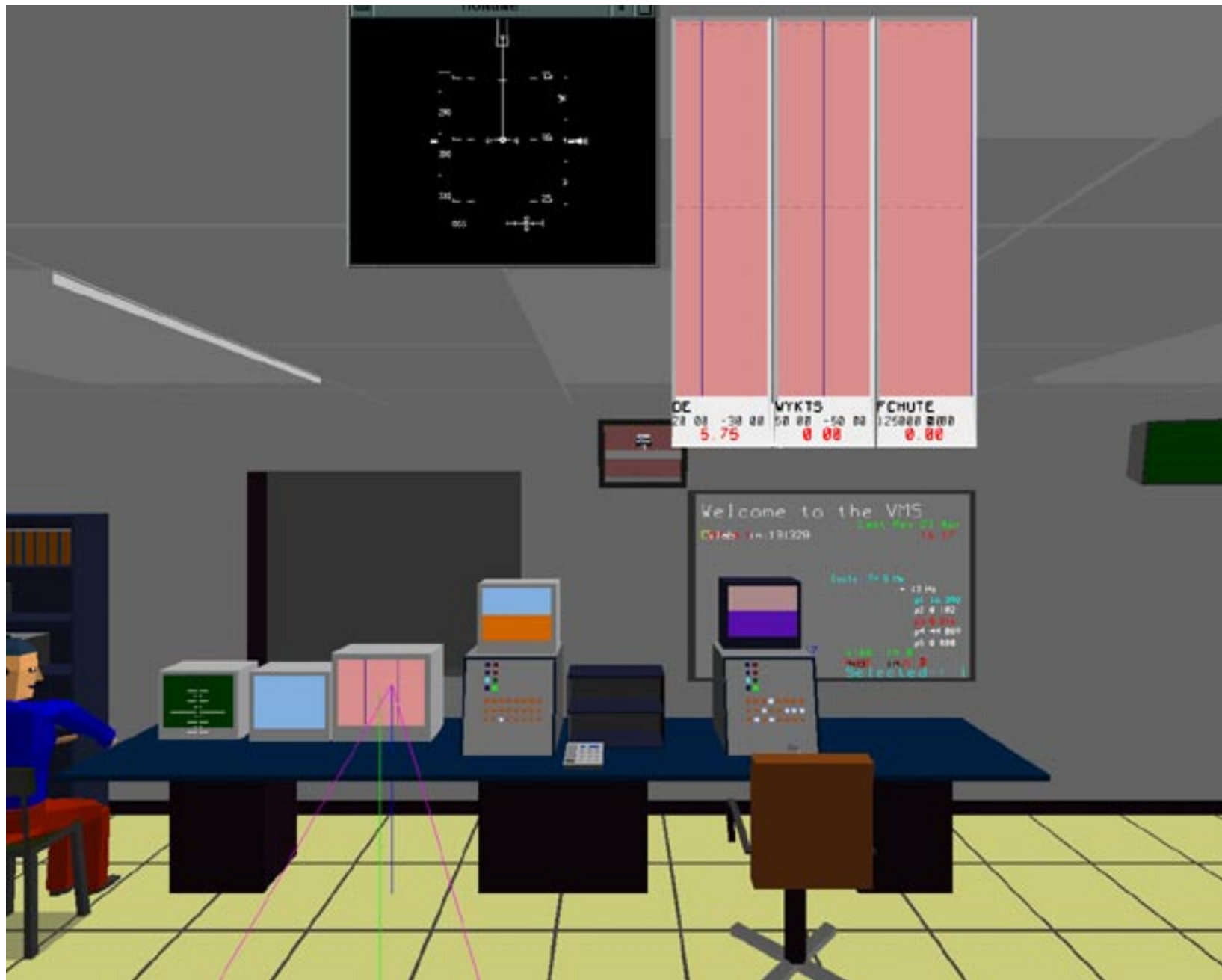
Graphic of Virtual VMS Control Room



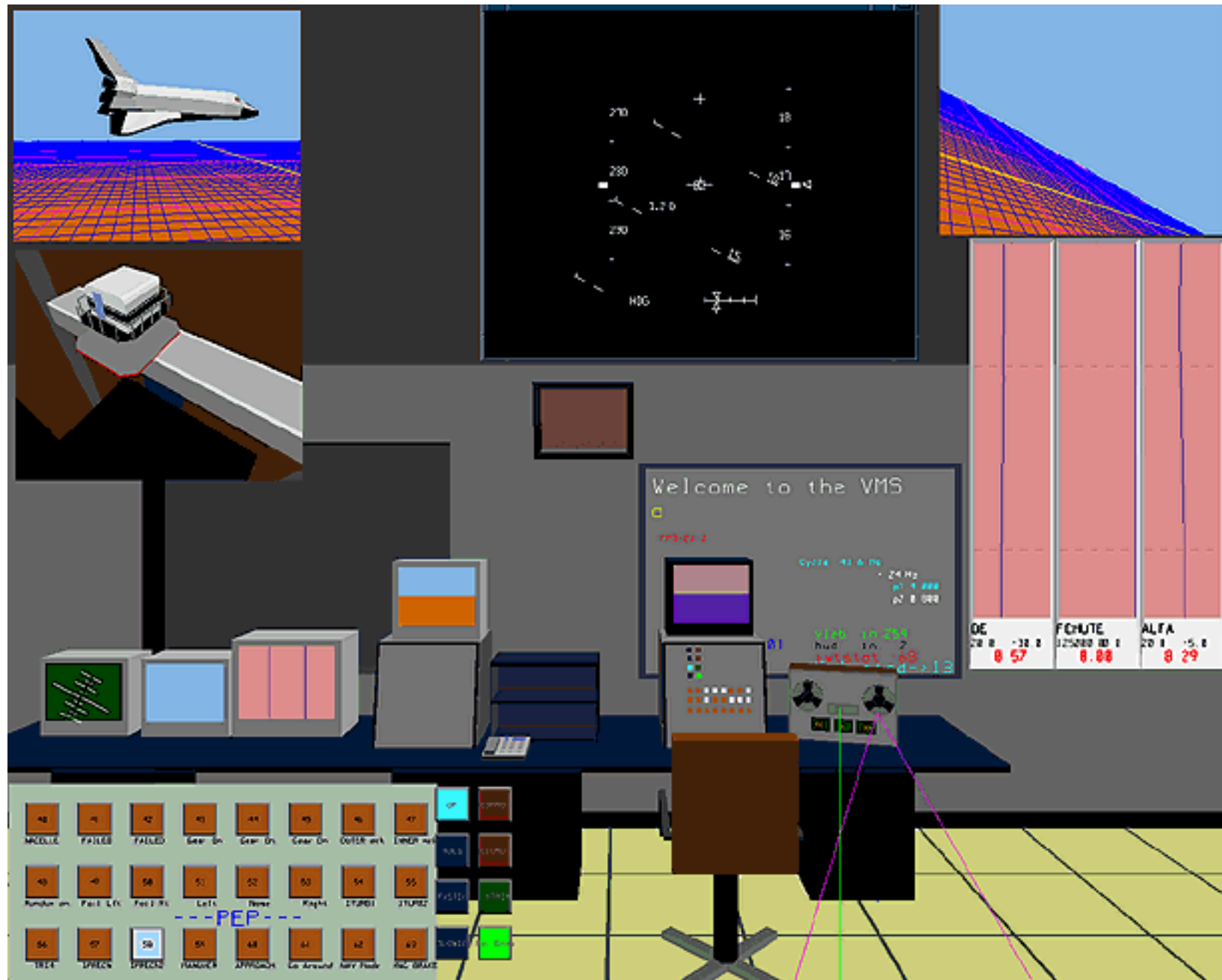
Graphic of Control Room and Motion System



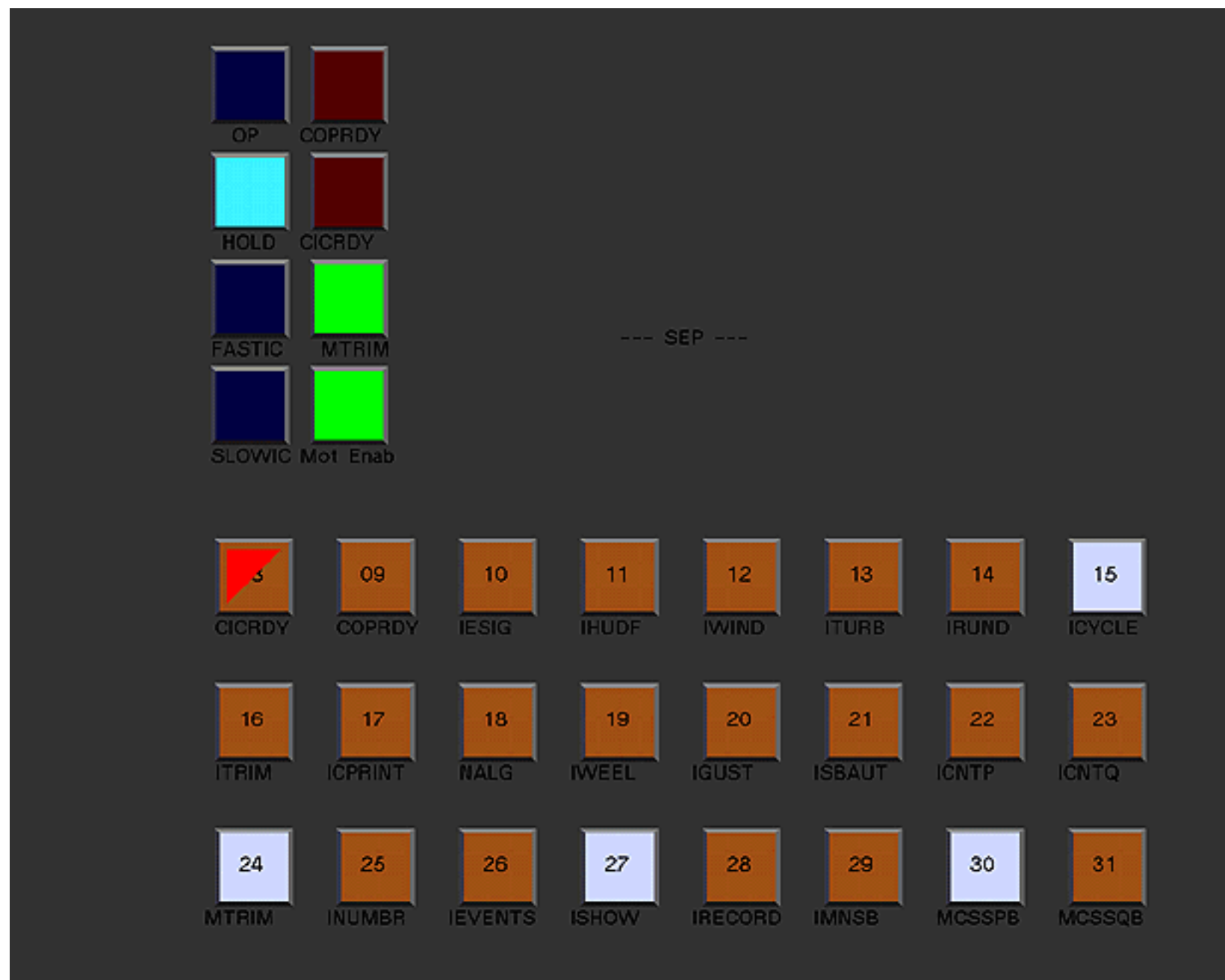
3-D Virtual Environment with 2-D HUD Overlay



Strip Charts Added to Display



Several 2-D Overlays Added to Virtual Lab



Zoom of Push Button Panel

AIRSPEED : 294. kts
GRND SPD : 503. fps
MACH NUMBER : 0.48

ALTITUDE : 16. ft
ALT RATE : 14.99 fps

FLT PATH : -18.0 deg
A o A : 6.4 deg

WEIGHT : 233000. lbs.
X C G : 1075.7 inches.
MASS MOMENT : 1.88

RUN NUMBER : 111
THRESHOLD CROSSING HEIGHT : 23.0
X POSITION AT MG TD : 2358.0
Y POSITION AT MG TD : 0.1
EQIV AIRSPEED AT MG TD : 196.6 knots
ALT RATE AT MG TD : 2.2 fps
Y POSITION AT NG TD : 54.5
MAX PITCH RATE DURING SLAPDOWN : -9.83 deg / s
Y MAX DEVIATION ON RUNWAY : 55.7
MAX GEAR LOAD -- N : 201. L: 157881. R: 223333.
SPEED AT NG TD : 199.0 knots

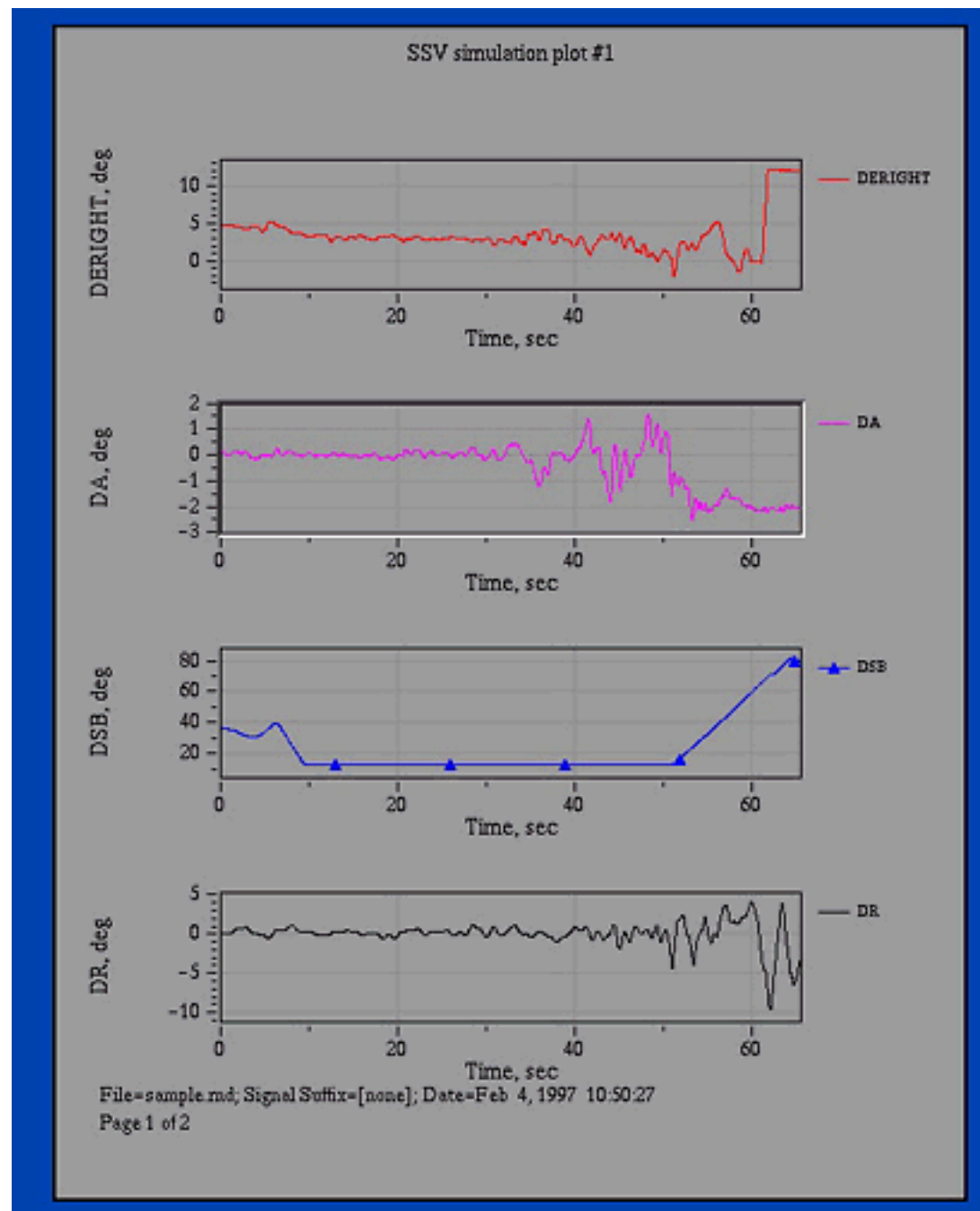
Left Brake Energy
82.9

Left Side Energy
-0.4

Right Side Energy
19.4

Right Brake Energy
127.0

End of Run Display



X-Y Plotting Using Quickplot

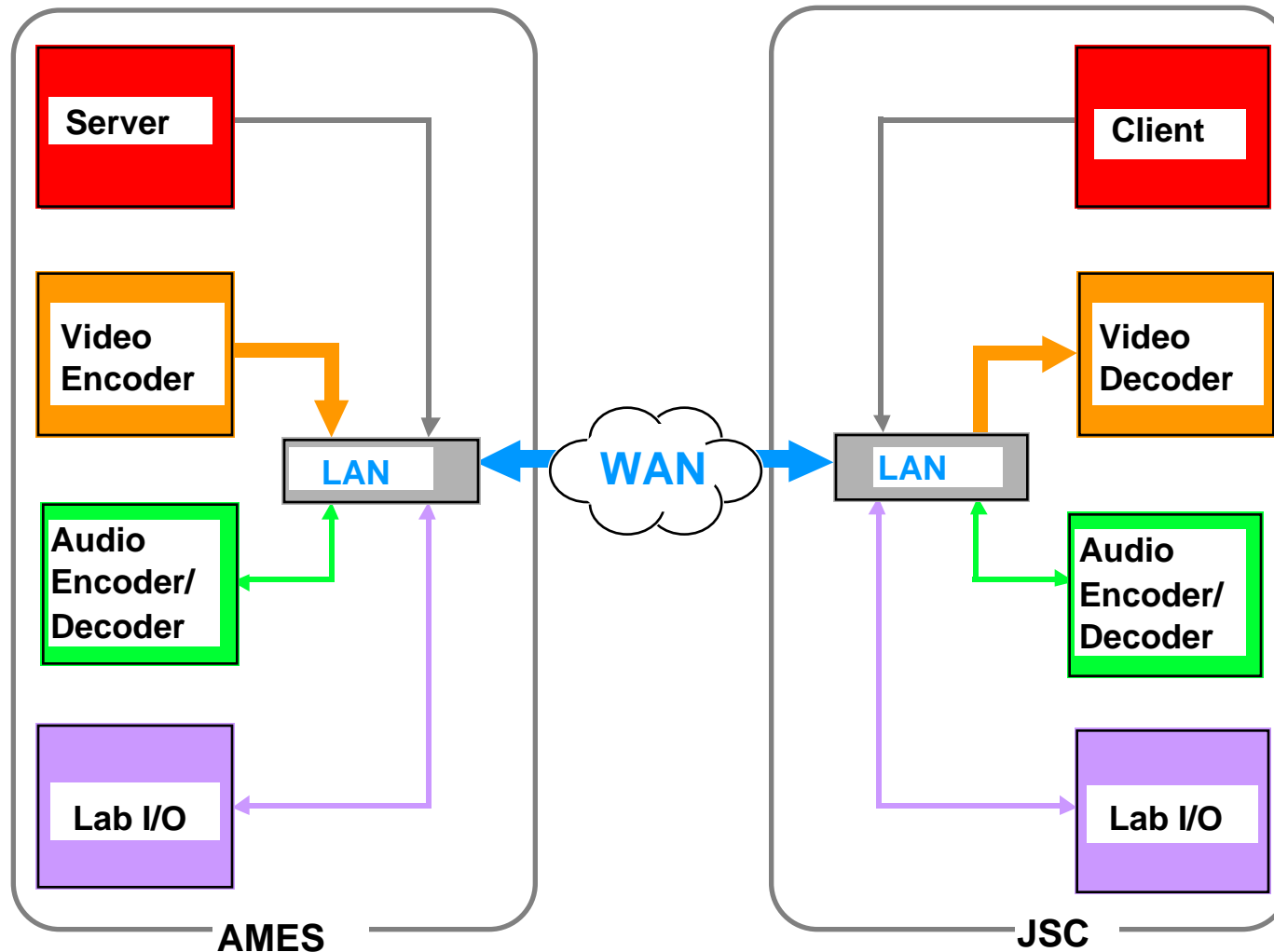


Another Perspective on Virtual Lab



**Ames Research Center
Aeronautical Test and Simulation Division**

VLAB Systems Block Diagram



Simulation Laboratories



Ames Research Center Aeronautical Test and Simulation Division



VLAB Configuration at the Johnson Space Center (JSC)



Simulation Laboratories



Ames Research Center Aeronautical Test and Simulation Division



‘Teleresearcher’ at JSC

Simulation Laboratories



Research Test Plans

- *Baseline Performance*
- *Regular Performance Testing*
- *Latency vs. Realtime at VMS*
- *Evaluate Alternate Communications Methods*
- *Compare Different Operational Modes/Procedures*
- *Evaluate Research Effectiveness with Different Configurations*